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From "THE PRACTITIONER" for January, 1906.

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Consulting Physician to St. Bartholomew's Hospital.



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IN the course of ages, experience has taught mankind many useful things whose utility science can even now with difficulty explain. One of these things is the use of certain vegetable infusions as beverages. One reason for using such infusions probably is, that experience has shown that boiled water is less harmful than water fresh from the well in places where the water supply is bad. In the middle ages, whenever an epidemic disease appeared, the cry was raised, "the wells are poisoned," and forthwith the populace proceeded to slaughter the Jews, on whom they laid the blame. In one particular the populace were right. They had noticed that those who drank from certain wells died, whilst those who drank from others escaped. They inferred that some of the wells were poisoned, and their inference was correct. But they were wrong in supposing that either the Jews or any one else had deliberately dropped arsenic, or any known poison, into the water. The wells were poisoned by the unsuspected filtration into them of sewage containing microbes, those living germs of disease whose very existence was unknown until a few decades ago. Science has shown that boiling the water containing these disease-germs destroys its noxious properties, because the germs are killed by the heat. But experience taught people the same truth ages ago, and they acted upon it, although they did not know the reason why. I had often heard of the wide prevalence, in Russia, of the custom of drinking tea, but it was only when I crossed the great plain between Warsaw and Moscow that the reason occurred to me. The water drunk in this plain is, I believe, drawn from shallow wells containing surface water, easily liable to contamination, and probably disagreeable in taste from organic matter, even when not dangerous. At every railway station the tea-urn or "samovar" is to be seen, and the people drink abundantly of tea. But it would hardly be called by that name in this country. It is simply hot water, scarcely coloured and barely flavoured with tea. In Moscow I dined with a

scientific man, and, after dinner, the samovar was placed on the table, and tea handed round. I asked my hostess how much tea she used, and she replied, "I am extravagant in tea, we are twelve at dinner, and I put in four teaspoonfuls, but most people would not put in so much." Here, I thought, is a difference from our rule of one teaspoonful for each person and one for the pot, and a reason why tea can be drunk to such a large extent in Russia without doing harm. As a contrast to this, I may describe what I saw in a herring boat at Whitby. I had gone out to spend the night in the boat and see the catch of herrings. We had not been long on board when the master, knowing I was a medical man, complained to me of his sufferings from indigestion. I did not understand why a sailor living a healthy open-air life should suffer in this way, but in a very short time the reason became evident. They made some tea and offered me a cup. But, instead of being a pale straw colour, and having a hardly perceptible flavour, as in Russia, it was as black as ink, and had a strong, bitter, and astringent taste. Judging from its appearance, I should think that tea had been put into the pot, not by the spoonful, but by the handful. A single cup was enough to cause much gastric discomfort, and several cupfuls every day were sufficient to produce any amount of dyspepsia. In other countries, where water is bad, as in Australia and South Africa, the practice of tea drinking is very prevalent.

But experience has shown mankind that the avoidance of danger from impure water is not the only advantage to be gained by drinking vegetable infusions. Safety might be obtained by simply boiling the water, but boiled water has an insipid taste, which is removed by adding to it various plants. Many have been tried, especially those having an aromatic smell, such as peppermint, &c. To a palate entirely unaccustomed to infusions, the taste of peppermint, perhaps, might be more agreeable than that of tea, but it lacks the other property which tea possesses, namely, that of stimulating. It is very important that we should understand clearly what we mean by stimulating, and that we should distinguish clearly between foods and stimulants.

Food is something which actually supplies energy to the body, in much the same way as coal supplies energy

to a steam engine. A stimulant supplies little or no energy, but enables a man to draw on his reserve stock in a way that he could not do without it. A stimulant, in fact, plays the same part in the operations of the body that bills do in the operations of commerce. In addition to his available capital, which he can use at short notice for commercial purposes, a man usually has some reserve capital which he cannot realise at once, so as to utilise it at short notice, when sudden demands are made upon him. If he cannot draw upon this reserve capital, he may become bankrupt for want of the power to utilise it. By means of bills he may borrow from this reserve, tide over a difficulty, save himself from bankruptcy, and accomplish transactions which he could not manage without them. But, if bills are too freely used, and reserve capital is too largely drawn upon, a man's bankruptcy, though postponed, is all the more disastrous. In the same way, stimulants enable us to draw upon our physiological capital, and to bring to bear upon a certain piece of work powers of body and mind, which we could not exert without their aid, and by this means we may be able to accomplish feats, bodily or mental, which would otherwise be beyond our power. But if stimulants are used too freely, all the reserves of energy, bodily or mental, will be used up to too great an extent, physiological bankruptcy will set in, and the wreck of body and mind that will ensue will be complete and deplorable.

Stimuli may be mental or physical. Amongst the most powerful of the former are love, pride, and ambition. These are not confined to man, but act upon the lower animals also. Once when racing along a road with a friend who was mounted on a horse while I was mounted on a pony, the pony's ambition enabled him for a while to keep pace with the horse, but as the longer stride of the latter began to tell, and he gradually forged ahead, the pony bit at him savagely in an attempt to hold him back and prevent him from winning the race. I have no doubt that the pony would gladly have welcomed whip or spur, or both, if the stimulus they supplied, however painful, had enabled him to win. In the struggle for existence amongst men, competition is very keen, and they naturally welcome stimulants which will enable them to do more than

they otherwise could. The use of stimulants is almost universal throughout the world. In countries where the vine grows, wine is largely used. In colder countries, where there are no vines, fermented liquors, or spirits distilled from them, are employed, and in a large portion of the world's area other plants, which have a strong action upon the nervous system, are preferred even to alcohol. Over a large part of India, opium is used, and to a less extent *cannabis indica*, but in many other countries various infusions are employed which act as stimulants without producing either stupor, like opium or alcohol, or mental disturbance like *haschisch*. The fungi used in Kamschatka and the betel nut in India probably act on the circulation like tobacco, but tea in China, coffee in Arabia, guarana in Brazil, maté in Paraguay, and cacao, or, as it is more commonly called, cocoa, in Central America and the West India Islands, all contain active principles very closely allied to one another, chemically and physiologically. The coca of Peru contains an active principle not so closely related chemically to tea as these others, but physiologically it also resembles tea in many respects, though differing from it in others. Many millions of experiments, lasting on through countless ages, must have been tried by mankind with infusions of leaves of various kinds, and it must have been some useful property which has led men to select from amongst them leaves so different in kind and coming from such different plants as those which I have just mentioned, but all of which have a similar effect upon the human organism. The effect which they do produce is purely that of a stimulant, as I have already described it. They enable a man to draw upon his reserves, mental and bodily, to an extent which he could not otherwise do, and give him greater mental or bodily power to meet any sudden demands, to overcome a difficulty, or to continue exertion long after he would have succumbed to fatigue without their aid.

In order to understand how these stimulants act, it may be necessary to make another physiological digression, and discuss the subject of fatigue.

One important function of the brain is to preserve the body from harm. If the hand touches a piece of hot iron the painful impression is at once carried by the nerves up to

the brain, and the hand is drawn away before much injury is done. If the brain were narcotised by opium, alcohol, or chloroform, no pain would be felt, the hand would not be withdrawn from contact with the iron, and it might thus become so severely burned as to be utterly useless. It is the quick appreciation by the brain of danger from without that thus protects the organism. In the same way it also protects the organism from dangers arising within it. The organs of the body are rarely worked to their full extent, but are kept well within those limits which it might cause serious injury to overstep. Thus it is that ordinarily when persons are undergoing violent exertion involving the hands or feet, the limbs or body, they are obliged by pain to relax the muscles before they break under the strain to which they are subjected, and the oppression on the chest and the pain in the heart, which violent exertion brings on, usually compel the individual to lessen it, or cease it altogether, before the heart has become injured. In the same way long-continued exertion causes fatigue in the muscles which is perceived by the brain, and the person is forced to rest long before his muscles are completely exhausted. Powerful mental stimuli, such as the desire to save oneself from imminent danger or death, or even ambition to win a race, may lead men to strain their muscles until they snap, or their hearts until they stop. But short of such serious results, powerful exciting stimuli may lead men to accomplish feats, of which they would have believed themselves incapable, and which, in truth, they could not have accomplished except under the influence of excitement. The same rule appears to hold good in regard to mental exertion, and most men are capable of a great deal more mental work than they actually perform. Here, again, the weariness, which mental work brings on, appears to be a safeguard, and not unfrequently one finds that people who have, during periods of excitement in which fatigue was not felt, overworked their brains for months together, fall into a condition of neurasthenia from which it is very hard to recover.

The effect of tea, coffee or cocoa appears to be three-fold, (1) on the circulation, (2) on the spinal cord, and (3) on the brain. Through the effect of these substances on the circulation, the flow of blood through the brain is increased, more

nutriment is supplied to the brain cells, and thus thought is quickened. The brain cells themselves are also probably affected by tea or coffee so that communication between them becomes more rapid, more complete, and more permanent than in ordinary circumstances, and thus it is that people think more clearly and speak more readily when stimulated by tea or coffee. On the other hand, these substances tend to keep up mental action when it is not wanted and prevent the sleep which ought to come on after exertion, and which is needed to restore the tired brain. But perhaps the most remarkable action which they have is that pointed out by Bennett and McKendrick,¹ viz., that they lessen or abolish the transmission of sensory impressions both in the peripheral nerves and the spinal cord, and thus interfere with the conduction of painful impressions to the brain. Amongst other disagreeable sensations they lessen the sense of fatigue. They thus give a sense of well-being and of power, which is very agreeable, and not only do they give the feeling of power but they actually enable men to do more and to endure longer than they otherwise could. In Peru the Indians are accustomed to chew coca leaves on long journeys. These leaves contain no nourishment, and yield no energy to the body, but they prevent a person from feeling the sense of fatigue and enable him to draw upon his reserve energy until his course is finished when he may again rest, take food, and replace the energy he has expended. The qualities of tea are well put in one of the Sloane Manuscripts, dated 1686, and quoted by Dr. Tebb in his excellent paper on "Tea, and Tea Drinking."² It was said "to purify the blood and kidneys, cure giddiness and pains in the head, vanquish superfluous sleep and heavy dreams, open obstructions, clear the sight, strengthen the memory, sharpen the wits and quicken the understanding." No wonder with such excellent qualities that the "cup which cheers, but not inebriates," should have become such a universal favourite, and if properly used it certainly is a great boon to mankind.

Unfortunately tea is liable to abuse as well as use, and just as the bills, which properly employed may greatly help a

¹ A. Bennett and J. McKendrick: *Edinburgh Med. Journ.*, October, 1873.

² *Tea, and the Effects of Tea Drinking.* By W. Scott Tebb, M.A., M.D., D.P.H. London: Cornell and Sons, 63, Borough Road, London, S.E.

commercial man, will bring about hopeless bankruptcy if overdrawn, so tea and its congeners, if abused, will bring about the most disastrous results. One of these is a consequence of the power of tea to lessen disagreeable sensations, for it not only lessens fatigue but it lessens hunger as well, and thus tends to prevent nutriment being taken which would otherwise build up the organism, and restore the energy taken from it by exertion under the influence of tea. All teas, however good, have this action, but in addition to it some teas have an injurious effect upon the stomach itself on account of the tannin which they contain. Tannin when taken along with butcher's meat hardens it and renders it less digestible, so that a meat-tea is often provocative of dyspepsia. Upon farinaceous food it has no such action, and the experience of people has shown that bread and butter, toast or rusks, go well with tea. Fish and eggs are, I think, softer than meat and do not suffer so much from the tanning action of the tea, whilst bacon is already hard and remains unaffected. But it is not only upon the food that tannin exerts its injurious action. It affects the mucous membrane of the stomach itself and lessens its digestive power. The different kinds of tea vary in the amount of tannin they contain, and according to Dr. Tebb¹ it is somewhat less in China tea than in India and Ceylon teas. It depends, perhaps, even more on the mode of preparing the tea than upon the tea itself. When boiling water is simply poured on the leaves, and is again poured off after standing for a few minutes, only a small proportion of tannin is extracted, but when the leaves are boiled or stewed a great deal of tannin is dissolved out, and is apt to produce severe dyspepsia.

It is thus evident that tea may interfere with nutrition in three ways. First, by lessening the feeling of hunger, second, by rendering food less digestible, and third, by interfering with the digestive power of the stomach. At the same time that it thus lessens the nutrition of the body, it enables the person to use up much more energy than he or she would be able to do without its aid, and the consequences of this are most evident in regard to the nervous system. Although tea prevents the

¹ Tebb : *Op. cit.*

sensation of fatigue from being felt for a while, yet exhaustion is going on, both in mind and body, and this usually at length causes disinclination either to mental or bodily exertion, and tends to destroy the power of doing any useful work, either mental or bodily, even when the attempt is made. Power of self-restraint is diminished and the person becomes nervous, unduly sensitive, timid, and emotional. Not unfrequently ringing in the ears is felt, giddiness, headache, sometimes very severe neuralgia and tremulousness. The tremors seem to be more readily induced by green tea than by black tea, and I have known of one case in which two or three cups of green tea were sufficient to induce marked tremor. An officer in the army, who was suffering from severe neuralgia, and who, though moderate in alcohol, took too much tea and tobacco, once consulted me. I cut off his tobacco and alcohol, but allowed him to go on with his tea. The neuralgia continued, and he consulted another medical man, who promptly cut off the tea as well with the satisfactory result that the patient quickly recovered. Neuralgia is very apt to occur in nervous people who are able ordinarily to take a great deal out of themselves, either by sheer force of will or under excitement, and are thus more liable to reduce themselves below normal than those of more lymphatic temperament. Neuralgia has been described as the prayer of a nerve for better blood and more of it, and if this is true, as I believe it to be, one can easily see how tea, by enabling these people to take even more out of themselves than they otherwise could, will render their neuralgia more severe and more continuous. It is evident that a similar result is to be expected in regard to other nervous functions, and that the stability of the brain may be so seriously impaired that the combination of starvation and stimulation, produced by excessive tea drinking, will certainly produce a tendency to mental derangement, even if it does not actually determine its onset.

But, in addition to its action on the nervous system, tea is a powerful stimulant to the circulation, and, if abused, will tend to weaken this, just as it tends to weaken the nervous system, and will lead to feebleness of the pulse and palpitations.

All teas are not equally injurious. Ceylon and Indian

tea are preferred by many people to China tea on account of their aroma and stimulating qualities, and, so long as they are taken in moderation and prepared in the right way by simple infusion for two or three minutes, and then pouring the water off from the leaves, they will suit healthy people very well. But whether it is on account of the higher proportion of tannin they contain, or some other reason which we do not yet know, they are not so good for weak digestions as China tea, which, especially if it is prepared in the way just recommended, by infusion for two or three minutes only, is less likely to cause dyspepsia than other kinds of tea.

The taste of tea is much affected by the nature of the water in which the leaves are infused. Hard water and water containing iron do not make good tea, and the chalybeate water is apt to make a very dark infusion from the tannin of the tea reacting on the iron in the water and producing ink. Water in which the hardness is "temporary," depending on the presence of calcium carbonate, may be softened by boiling, which drives off the carbonic acid gas, and thus precipitates the calcium carbonate which it keeps in solution in the water. But water from which the gases have been driven off is insipid, and water which has been boiled twice, so that all the gases it would usually contain have been removed, does not make good tea. In places where the soil is chalk and limestone, and the water is consequently hard, it is better to make tea with boiled soda-water, Apollinaris, Salutaris, or some other effervescent water free from lime. This procedure tends also to lessen the constipation which the hard water is apt to produce.

Where these waters cannot be had, a pinch of bicarbonate of soda into the tea-pot improves the infusion.

The physiological action of tea is usually attributed almost entirely to the alkaloid, theine or caffeine, which it contains, but I do not think that this can be the case because green tea, which contains no more alkaloid than black tea, has a much more powerful effect upon the nervous system, an effect which cannot be explained by the somewhat larger proportion of tannin, and must, I think, be due to some other constituents in the leaf. Green tea and black tea are not obtained, as many

people suppose, from different varieties of the plant, but only differ in their method of preparation ; the leaves which form the green tea being roasted in a pan shortly after they are plucked, while those that form black tea are allowed to undergo a form of fermentation before roasting.

To sum up shortly what I have said in this paper. Tea, when properly prepared, and taken in moderation, is both useful and agreeable. When taken in too great quantity, or along with butcher's meat, when too strong, when infused too long, or still more when boiled and stewed, it is apt to produce digestive troubles. When taken in excess it may produce nervous symptoms of the most serious character, and facilitate, if it does not actually produce, mental degeneration.





